SIEMENS

MOBILETT XP (Hybrid / Eco)

SP

Installation and Start-up

System

Installation and Start-up

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Performing the work

Any technician duly assigned by the local Siemens office is authorized to perform maintenance and service work.

Certain tasks may also be performed by other technical personnel (e.g. the customer's hospital technicians). These tasks are marked by the icon shown here.

In such cases it is absolutely necessary:

- to observe all instructions in the text and graphics;
- to use the specified tools, test equipment and aids.

You can also contact your national Siemens Uptime Service Center for support.

Special text indicators

⚠ DANGER	**DANGER indicates an immediate danger that if disregarded will cause death or serious physical injury.** ➪
⚠WARNING	**WARNING indicates a possible danger that if disregarded can cause death or serious physical injury.** ➪
⚠CAUTION	**CAUTION used with the safety alert symbol indicates a possible danger that if disregarded will or can lead to minor or moderate physical injury and/or damage to property.** ➪
NOTICE	**NOTICE used without the safety alert symbol indicates a possible danger that if disregarded can or will lead to an undesirable outcome or state other than death, physical injury or property damage.** ➪
NOTE	**NOTE is used to indicate information that explains the proper way to use devices or to carry out a process, i.e., provides pointers and tips.**

Icons

Warning about ionizing radiation or radioactive substances. Tests and adjustments that must be performed with the radiation switched on are indicated by this radiation warning icon.

.

Dangerous electrical voltage > 25 VAC or > 60 VDC.

Caution! General hazard warning.

ESD: Warning about electrostatically sensitive components.

Report icon. Used to indicate entries in certificates.

Certain tasks can also be performed by other technical personnel (e.g. the customer's hospital technicians).

U S Certain sections apply only to the USA. These sections are marked with this icon.

Fig. 1:

Information on product safety and protective measures

⚠ DANGER

Lethal electric shock and radioactive contamination hazards exist.
- While troubleshooting or servicing, individuals can come into contact with dangerous components.
- Some tests and adjustments must be performed with the radiation turned on.

Disregarding the safety instructions will lead to death or serious bodily injury.

- **When performing service and tests always observe:**
- **- the product-specific safety information contained in the technical documentation,**
- **- and the general safety information (TD00-000.860.01...).**
-
- **Remove or install components only if:**
- **- the system is switched off, and**
- **- the capacitors are discharged, and**
- **- the ESD guidelines are followed, and**
- **- for the XP Hybrid, the batteries are disconnected.**
-
- **Tests and adjustments that must be performed with the radiation switched on are marked by this radiation warning icon. The required radiation protection measures must be followed for these adjustments.**

⚠ DANGER

Lethal shock hazard exists.

Anyone performing troubleshooting and/or service with the safety covers off may come into contact with live parts. This hazard exists as long as:

- the power supply is connected;

- the capacitor bank or individual capacitors are still charged; capacitors may still be charged even when the system is switched off and the power cord is disconnected (e.g. due to defective fuses)!

- the battery blocks in the XP Hybrid are connected!

Disregarding the safety instructions will lead to death or serious bodily injury.

- ➪ **Make sure that no parts or tools fall into the unit;**
- ➪ **Do not touch potentially dangerous components(Fig. 2 / p. 10)**
- ➪ **If loose parts must be removed from the unit, use only insulated tools;**
- ➪ **Protect the work area so that no other persons are able touch the unit while the covers are open or removed!**

- Switch the unit off before servicing or maintenance. Always disconnect the power plug first.
- XP Hybrid: Make sure that the main switch and the battery mode are switched off.
- The capacitor bank discharges to < 40 V in approx. 15 minutes.
- The safety covers can be removed after this period has elapsed. The locations with dangerous voltage still require extreme caution (see (Fig. 2 / p. 10)).

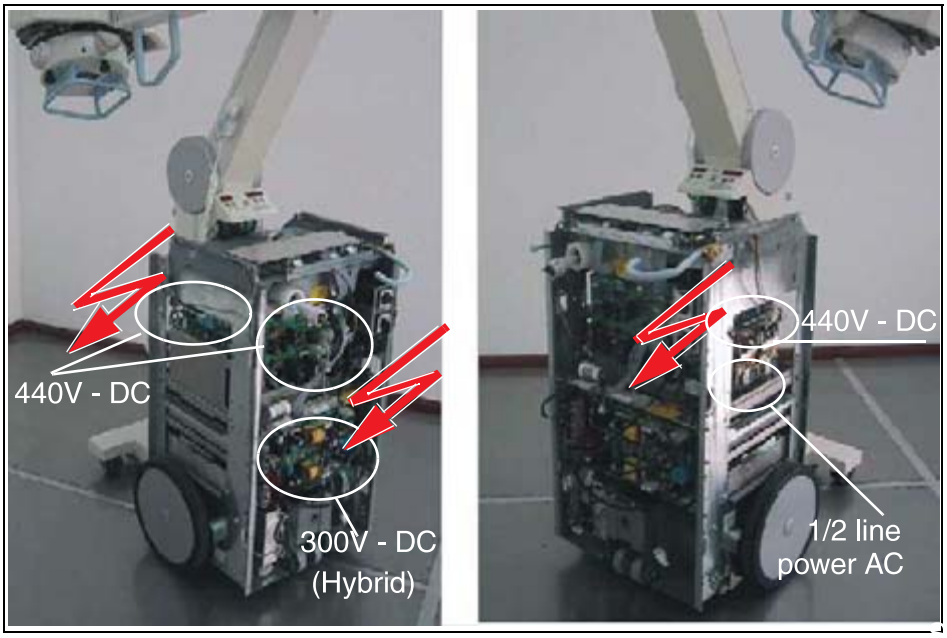

Fig. 2: Locations with dangerous voltage

With housing covers open and safety covers removed.

Back:

Dangerous DC voltage (440V) on capacitor bank (D927)

Left:

Dangerous DC voltage (440V) directly on capacitor bank!

Right:

Dangerous DC voltage (440V) directly on capacitor bank!

Dangerous AC voltage (> 100V or > 60V half line voltage) on power supplies U1 and U2 as long as the power cord is connected.

Additionally for XP Hybrid:

Dangerous DC voltage (300 V) from the battery block to PCB D982!

Always disconnect the battery plug from BK1-BK4.

System overview - user

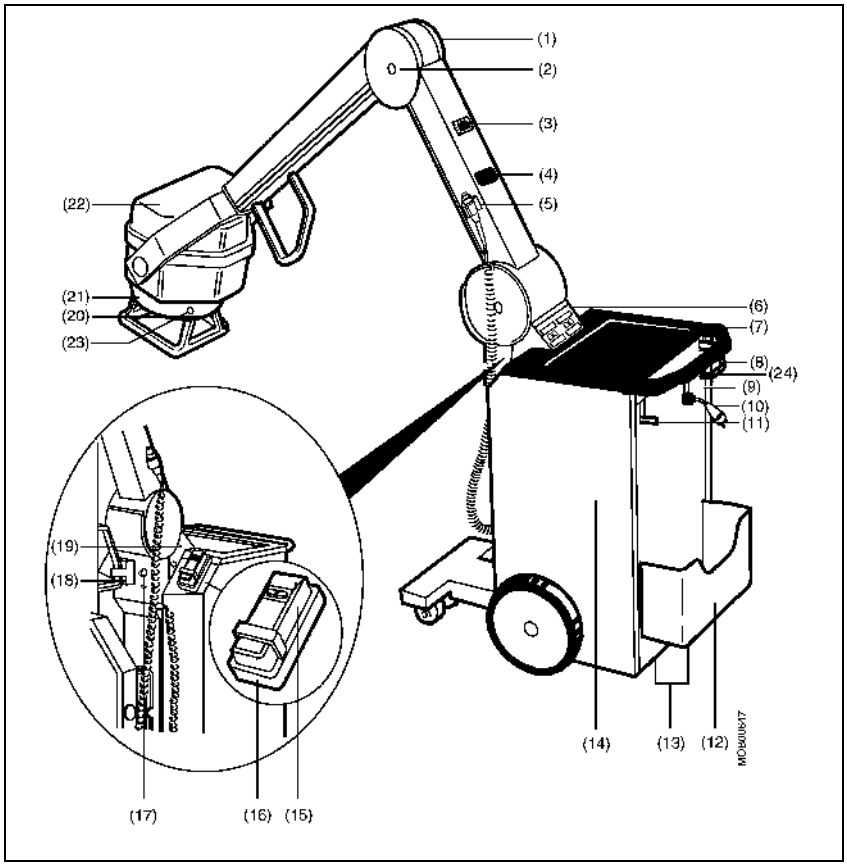

Fig. 3: User overview_01

(1) Hanger for lead apron	(13) Castors
(2) Articulated arm	(14) Console with chassis
(3) Sensor for IR remote control (optional)	(15) IR remote control (optional)
(4) DAP display (optional)	(16) Holder for IR remote control (optional)
(5) Exposure switch (S27)	(17) Potential equalization connector
(6) Control panel and display field	(18) Transport safety device
(7) Transport handle	(19) Stand column
(8) Hand/parking brake handle	(20) Multileaf collimator
(9) Main switch	(21) DAP ionization chamber (optional)
(10) Power cord	(22) X-ray tube assembly
(11) Brake handle for cable winch	(23) Light localizer buttons (two sides)
(12) Cassette compartment	(24) Motor control (Hybrid)

Orientation

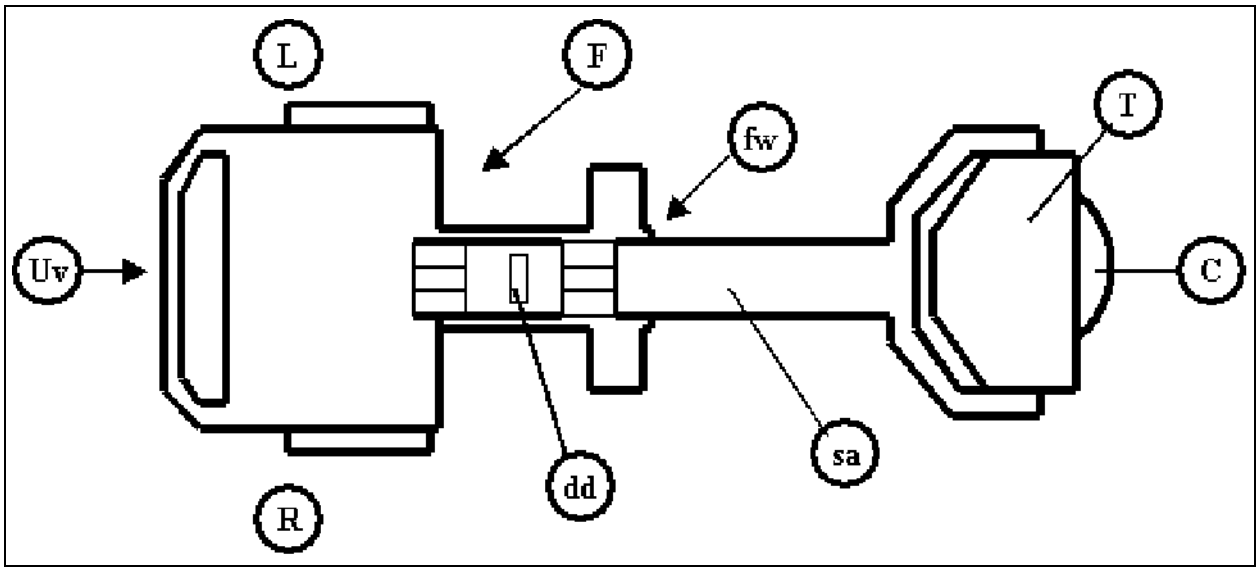

Fig. 4: Top view of system_01

System orientation to clarify the technical description	
Abbreviations	**Explanation**
Uv	User view - back (**U**ser **v**iew)
L	Left side of unit (**l**eft)
R	Right side of unit (**r**ight)
F	Front side (**f**ront)
fw	Front wheels (**f**ront **w**heels)
sa	Support arm (**s**upport **a**rm)
T	Tube (single **t**ank)
C	Multileaf collimator (**c**ollimator)
dd	DAP display (**d**ose **d**isplay)

NOTE

These orientation indicators are used in all technical documents. Descriptions are always from the "forward travel" user view. Always use this perspective when communicating with third parties (e.g., USC/HSC).

System overview - service

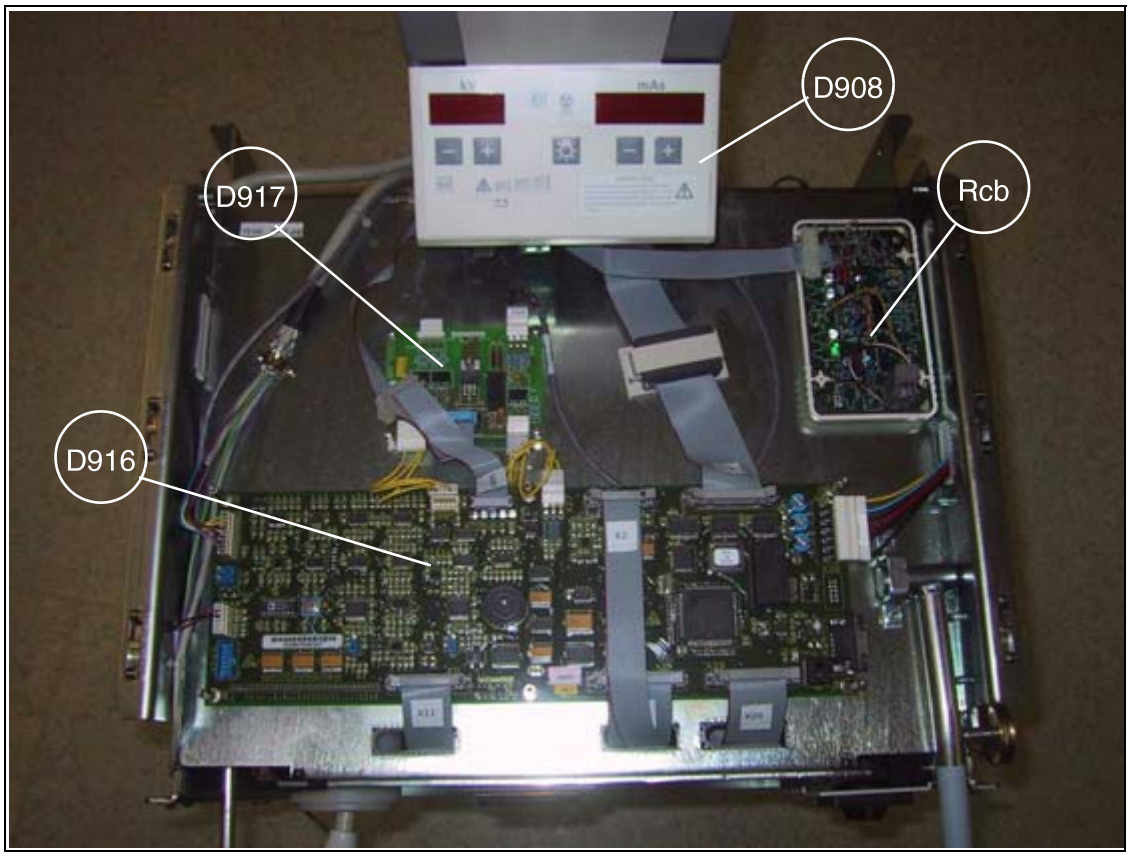

Fig. 5: Top view_01

Common parts of MOBILETT XP, Eco and Hybrid	
Abbreviations	**Explanation**
D908	User display and control
D916	CPU board
D917	Galvanic separation for S27/DAP/remote
Rcb	Remote control board (remote control option)

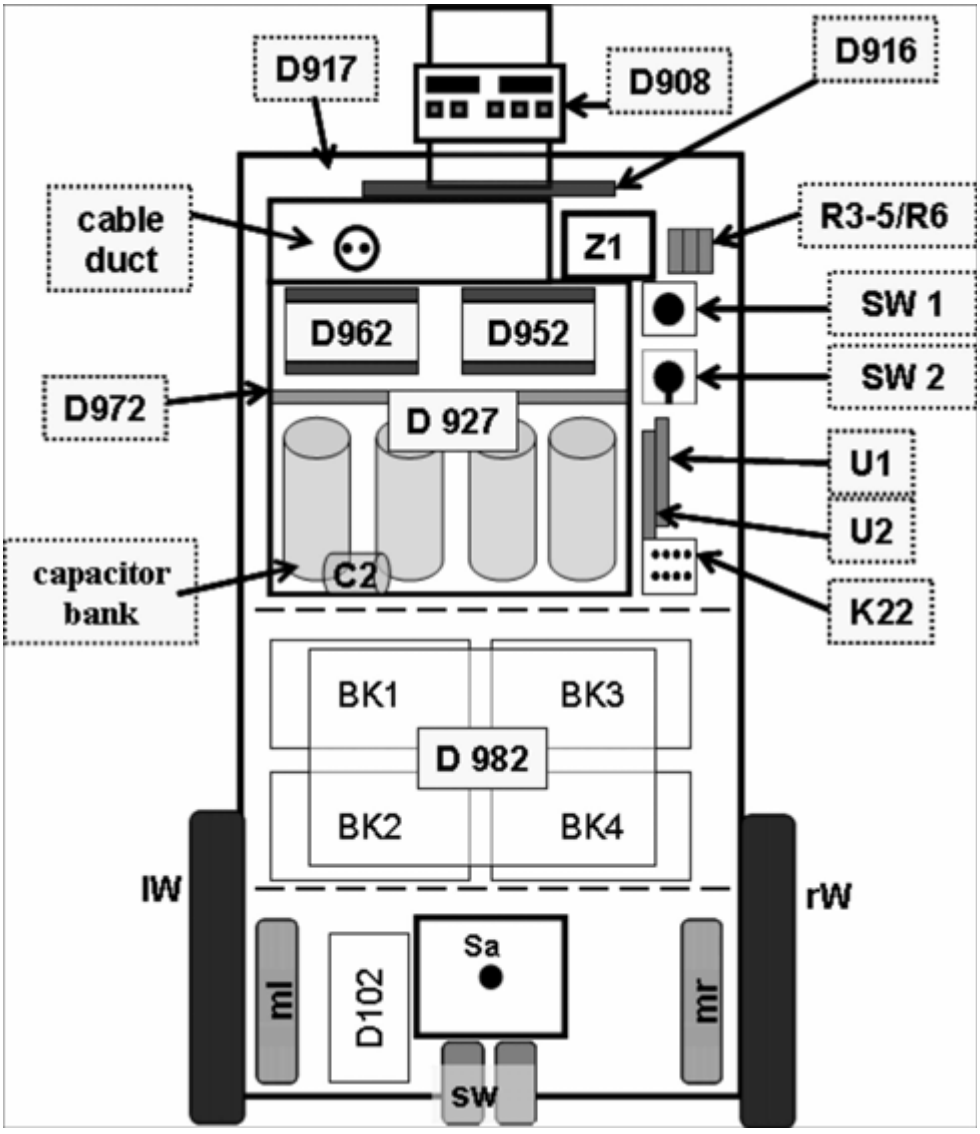

Fig. 6: Schematic overview of XP, Eco, Hybrid

Common parts of MOBILETT XP, Eco and Hybrid	
Abbreviations	**Explanation**
SW1	Key switch, power ON/OFF
Z1	Line filter
C1 (R1)	Capacitor for inverter with discharge resistor (front left side/not shown here)
C2 (R2)	Starter capacitor with discharge resistor
R3-5/R6 (Front right)	R3-R5 internal discharge resistor for capacitor bank R6 separate discharge resistor for service
Capacitor block	12 x 10 mF capacitors, mounted with D972
K22	Main relay

U1	+5V/± 15V power supply
U2	+24V power supply
D927	Power Supply
D952	Capacitor bank charging board (behind D927)
D962	kV inverter (behind D927)
D972	Capacitor bank board (behind D927)
Sa	Support arm adjusting spring
sw	Support rollers
Additional components for MOBILETT XP Hybrid only	
SW2	Op. mode selector (battery/off/line voltage)
D982	Battery charger
D102	Motor drive control
BK1/BK2	Battery block, left
BK3/BK4	Battery block, right
mr/ml	Motor right/motor left
Optional parts for MOBILETT XP; Eco and XP Hybrid (not shown)	
DAP chamber	Dose area product measuring chamber (mounted on the collimator)
D991	DAP adapter board (mounted in the collimator cover)
DAP display	DAP display board (mounted in the lower arm segment cover)

Cleaning

- Always disconnect the MOBILETT from the power supply and switch it off before cleaning or disinfecting it.
- Never use abrasive cleaners or cleaning agents with solvents (e.g. cleaning solutions, alcohol or spot removers), since they may damage housing surfaces.
- Do not spray anything on or into the unit.
- Wipe off the MOBILETT with a cloth moistened with water or a diluted, lukewarm solution containing water and dishwashing liquid.

For more information, see the section on "Cleaning and disinfection" in the operating instructions.

Required Documents

✍ Check the documents delivered for completeness.

Ring binders containing user documents:

• Operator Manual	SPR8-230.621.01..

Ring binders containing technical documents:

• General safety information	TD00-000.860.01...
• Installation and Start-up	SPR8-230.814.01...
• Maintenance Instructions	SPR8-230.831.01...
• Maintenance Protocol	SPR8-230.832.01...
• Troubleshooting Instructions	SPR8-230.840.01...
• Replacement of Parts	SPR8-230.841.30...
• Wiring Diagram	SPR8-230.844.01... SPR8-230.844.05...
• Disposal instructions	SPR8-230.861.01...
• Manufacturer's certificates	n.a.

Required tools, test equipment and aids

- Standard service tool kit
- Digital multimeter
- Device leakage current measuring device
- Protective ground wire tester

U
S

- Storage oscilloscope (± 2.5 % accuracy) or kV meter.
- Storage oscilloscope (±2.5 % accuracy) or mAs meter.
- Dosimeter.

Information on start-up

- The start-up procedure described here corresponds to a functional test. All adjustments and calibrations are performed at the factory. The MOBILETT XP (Hybrid) is ready for operation on completion of the start-up report.
- The unit can be connected to line voltages of 100-130 V (± 10%) or 200-240 V (± 10%). The unit automatically adjusts to the existing line voltage.

NOTE

Observe the nominal current of the fuses for the on-site power connections:

- 15A slow-blow (on-site) for 100-130V ± 10% or

- 15A slow-blow (on-site) for 200-240 V ± 10% line voltage.

The power cable for this device is equipped with a standard safety plug.

Attach a power plug that is compliant with local standards if necessary.

- Following start-up, country-specific tests must be performed if necessary.

e.g.:

Acceptance test according to §16 of the X-ray Ordinance (Germany):

Use the measurements in the test certificate provided as the initial values for the required measurements.

The following values were measured by the manufacturer; refer to the test certificate:

- Brightness of the light localizer
- Filter values (Al equivalent for tube assembly and collimator)
- Coincidence of light field and radiation field
- Accuracy of the tube voltage
- Accuracy of the kV value steps
- Accuracy of the mAs values
- Reproducibility of dose values

- The test/measured values marked by the report icon must be entered in the start-up report located at the end of this manual.

NOTE

Recording information immediately during start-up saves time.

Fill in the report form after completing each task.

The start-up report is a component of this documentation.

Information on the protective conductor resistance test

Observe the instructions in the "Safety Rules for Installation and Repair" (ARTD-002.731.17 ...).

The protective conductor resistance of 0.2 ohms must not be exceeded.

Initial measurement

Perform the protective conductor test after completion of all work.

The measurement must be performed according to DIN VDE 0751, Part 1 (see ARTD Part 2). The protective conductor resistance for all touchable conductive parts must be measured during the normal operating state of the system.

Make sure that control cables or data cables between the components of the system are not mistaken for protective conductor connections.

During the measurement, move the power cable and additional connection cables with an integrated protective conductor section by section to detect cable breaks.

The protective conductor resistance must not exceed 0.2 Ohms.

The values must be recorded as the first measured values in the protective conductor resistance report, and the measuring points must be given.

The measuring procedure and the measuring device used (designation and serial number) must also be documented.

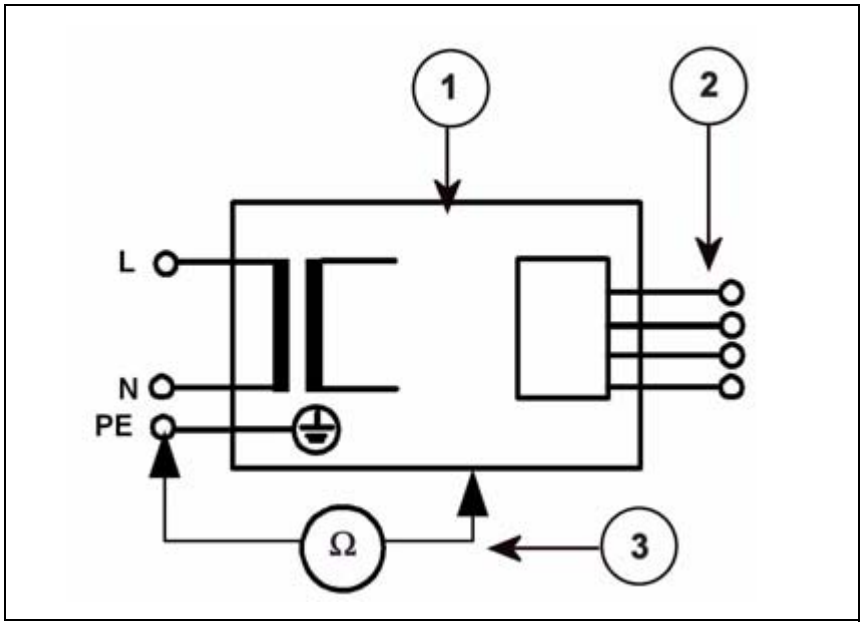

Fig. 7: Measuring circuit for measuring the protective conductor resistance for units that are disconnected from power, in compliance with DIN VDE 0751-1/2001-10, Fig. C2.

Pos. 1 = System

Pos. 2 = Application part type B (if available)

Pos. 3 = Measurement setup (integrated into measuring device)

Repeat measurement

In the case of maintenance or repairs, perform the protective conductor resistance measurement again.

Document and assess the values determined in the repeat measurement.

The measurement must be performed according to DIN VDE 0751, Part 1 (see ARTD Part 2). The protective conductor resistance for all touchable conductive parts must be measured during the normal operating state of the system.

Make sure that control cables or data cables between the components of the system are not mistaken for protective conductor connections.

During the measurement, move the power cable and additional connection cables with an integrated protective conductor section by section to detect cable breaks.

The protective conductor resistance must not exceed 0.2 Ohms.

The values determined in the repeat measurement must be recorded and assessed in the protective conductor resistance report, and the measuring points must be given.

The measuring procedure and the measuring device used (designation and serial number) must also be documented.

NOTE

For evaluation purposes, the first measured value and the values documented during maintenance or safety checks must be compared to the measured values. A sudden or unexpected increase in the measured values may indicate a defect in the protective conductor connections (protective conductor or contacts) - even if the limit value of 0.2 ohms is not exceeded.

Information on measuring the leakage current

Observe the instructions in the "Safety Rules for Installation and Repair" (ARTD-002.731.17 ...).

⚠WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

➪ **The leakage current measurement may be performed on systems of protection class I only after the protective conductor test has been passed.**

Initial measurement

Perform the leakage current measurement after completion of all work.

Perform the measurement according to DIN VDE 0751, Part 1 (see ARTD-002.731.17....), and record the determined value as the first measured value.

Measurement of the leakage current according to the differential current method (measurement setup according to (Fig. 8 / p. 22)) must be given preference, since this method is not dangerous to the person performing the measurement and other persons.

However, please note the minimum resolution of the leakage current measuring device and any additional manufacturer information restricting the use of the measuring device.

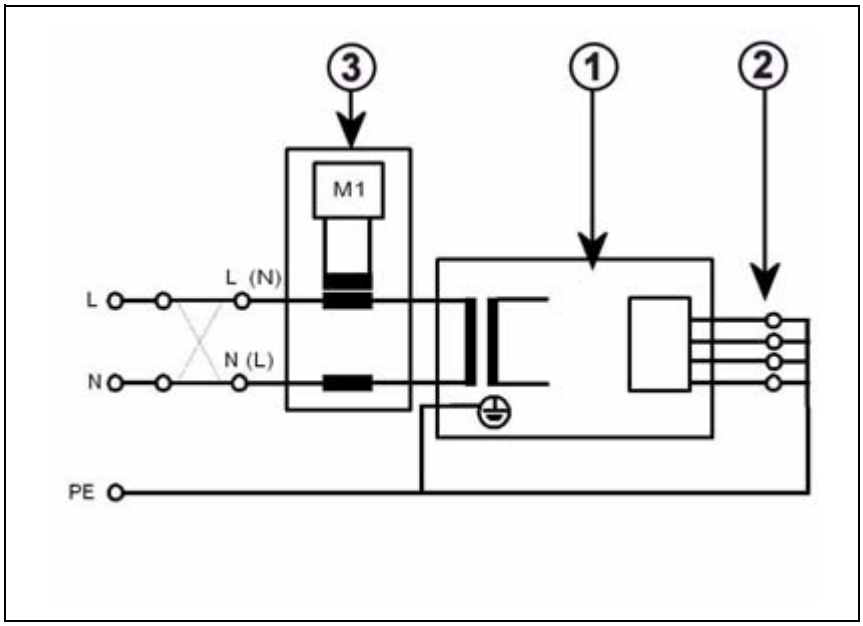

Fig. 8: Measuring circuit for measuring the system leakage current according to the differential current method in compliance with DIN VDE 0751-1/2001-10, Fig. C6 for protection class I.

Pos. 1 = System

Pos. 2 = Application part type B (if available)

Pos. 3 = Measurement setup (integrated into measuring device)

If the direct measurement of the leakage current is used (measurement setup according to (Fig. 9 / p. 23)), the system must be insulated during the measurement and must not be touched.

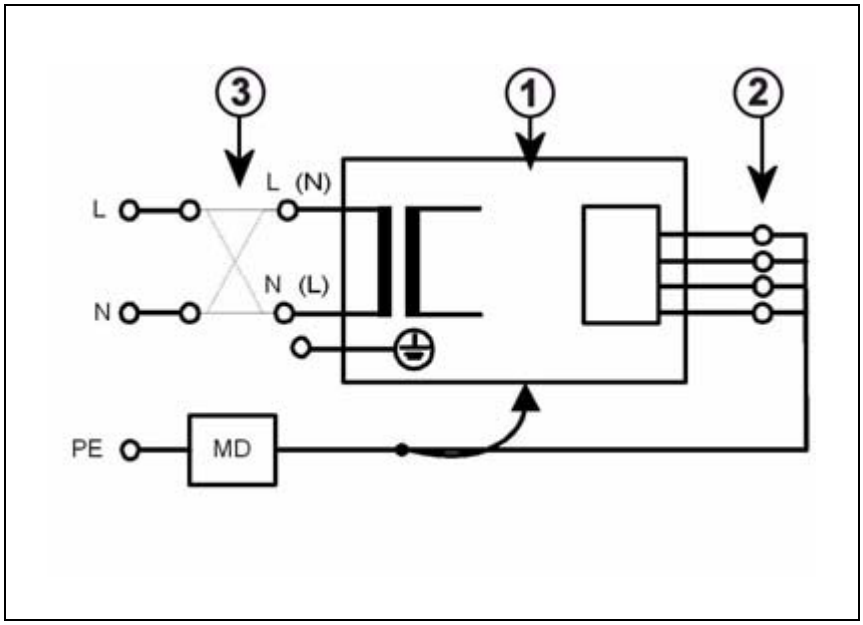

Fig. 9: Measuring circuit for direct measurement of the system leakage current in compliance with DIN VDE 0751-1/2001-10, Fig. C5 for protection class I.

Pos. 1 = System

Pos. 2 = Application part type B (if available)

Pos. 3 = Measurement setup (integrated into measuring device)

⚠WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

- ➪ **No housing parts of the system may be touched during direct measurement of the leakage current (measurement setup according to (Fig. 9 / p. 23)).**
- ➪ **Third-person access to the system must be prevented.**

The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.

Enter the highest value as the first measured value in the system leakage current report.

This value must not exceed the permissible leakage current values according to DIN VDE 0751-1/2001-10, Table F.1, line "leakage current for devices according to remarks 1 and 3", of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This must also be documented.

Document the measuring procedure (differential measurement or direct measurement) and the measuring device used (designation and serial number).

Repeat measurement

When maintenance or repair work is performed on the primary power supply circuit (e.g. repairs to the power-on circuit or replacement of the line filter), the leakage current measurement must be repeated.

The same measuring conditions as in the first measurement apply.

Record and assess the highest value determined in the repeat measurement in the existing leakage current report.

This value must not exceed the permissible leakage current values according to DIN VDE 0751-1/2001-10, Table F.1, line "leakage current for devices according to remarks 1 and 3", of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This must also be documented.

Document the measuring procedure (differential measurement or direct measurement) and the measuring device used (designation and serial number).

NOTE

For evaluation purposes, the first measured value and the values documented during maintenance or safety checks must be compared to the measured values. A sudden or unexpected increase in the measured values may indicate that a fault has occurred in the primary power supply circuit (damaged insulation, damage from moisture, defective interference suppressor, etc.) - even if the limit value of 2.5 mA is not exceeded.

Unpacking

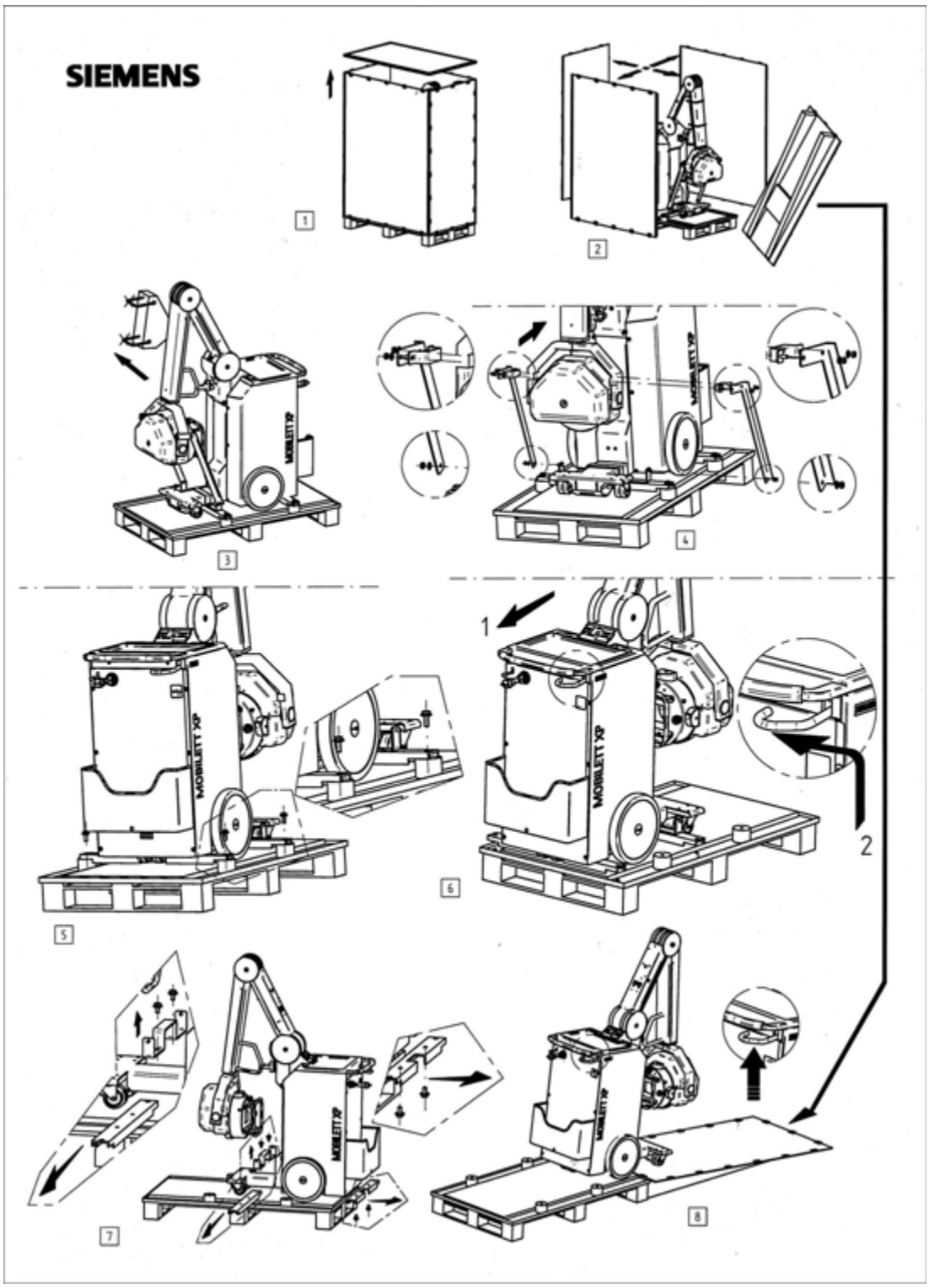

Fig. 10: Unpacking

- Please follow the unpacking instructions (Fig. 10 / p. 25).
- Check the manual movement mode and the hand brake.

Visual inspection

✍
- Check the unit for external damage (cracks, breaks, scratches, corrosion etc.).
- Check whether the single tank or the multileaf collimator show any signs of mechanical defects which might impair the radiation protection.

Mechanical function test

Cable winch

- Pull out the cable until it is completely unwound.
- Hold the cable with one hand near the duct to slow it down as it is being wound. Pull up the brake of the cable winch and wind up the cable completely.

This device is equipped with a standard safety plug. Attach a power plug that is compliant with local standards if necessary.

Support arm movements

- Unlock the support arm. Then check its movements, including several stops. If the DAP chamber is included in the scope of delivery, it must be attached to the collimator. The arm should be easy to move through its full range using one hand and should stop in any position without any additional movement (up or down).

Fig. 11: Positioning of support arm

Single tank and collimator movements

- Turn the collimator with the handle to the end positions ±90°.
- Rotate the tube to all of its commonly used working and park positions.

Identification (labeling)

All identification labels are included in the scope of delivery.

- Check the labeling according to the "Labels" chapter in the operator's manual.
- The device identifier should be entered in the start-up report.

Regional labeling

- Attach the radiation warning label to the control panel as shown in (1//Fig. 12 / p. 28). Select the right language version.

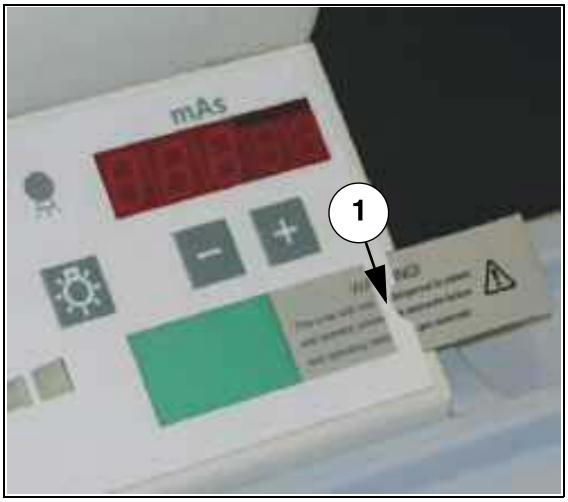

Fig. 12: X-ray radiation warning label

- The label "DANGER! Explosion hazard..." is supplied in a number of languages. Select the correct language version and attach it to the backside (cover with cassette holder) in accordance with the operator's manual.

- Only if required by the user:

  Affix the “Do not open doors with the device" as shown in (Fig. 13 / p. 28).

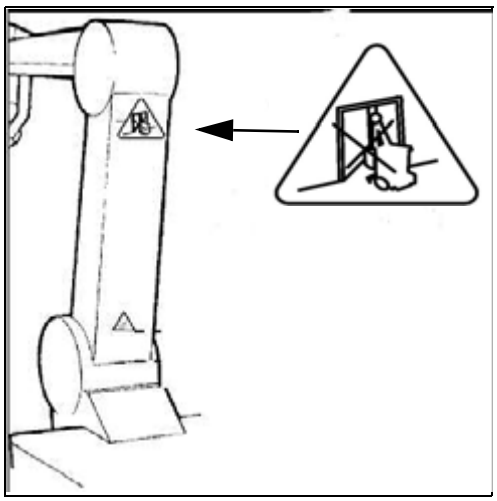

Fig. 13: "Rambo" label

- For Germany only:

  Select the 1.5m, 2.5m or 3.5m “control area" label as required by the customer and affix it to the bottom of the arm as shown in (Fig. 14 / p. 29).

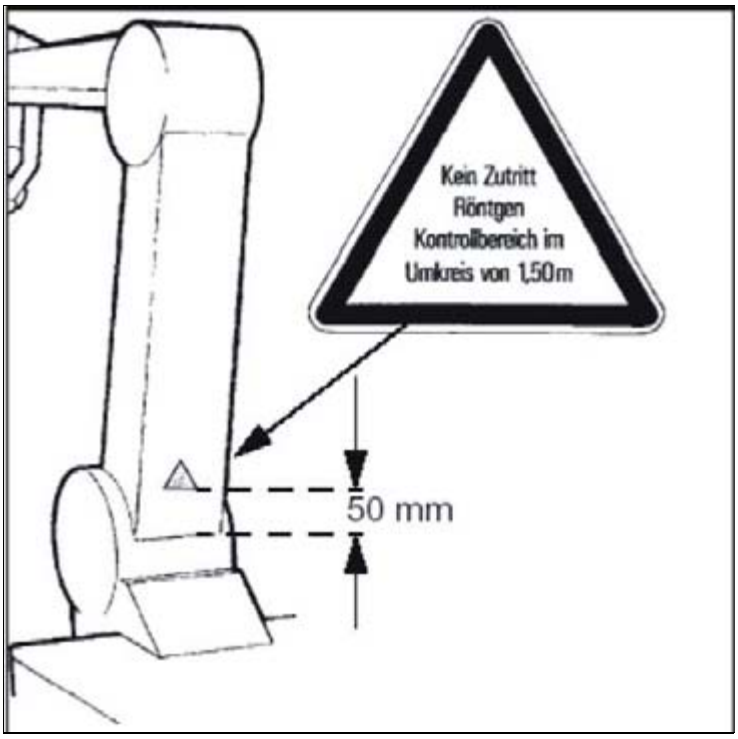

Fig. 14: "Control area" label

Line voltage

✍ Check the local line voltage by testing a power outlet with the DVM.

NOTE **The system automatically adjusts to the existing (local) line voltage.**

Operating Elements and Displays

✍ Connect the power plug and check whether the AC symbol (~) lights up on the control panel (Fig. 15 / p. 31)

Switch the unit on. Wait for initialization (audible acoustic signal and flashing kV- / mAs displays).

NOTE

If the unit has not been used for some time, error ERR13 may appear, indicating a high device leakage current on the capacitor bank.

Switch the system off and then on again to correct this problem.

If the error persists after several power-off/on cycles, perform the "Forming the capacitor bank" service step as described in the troubleshooting instructions.

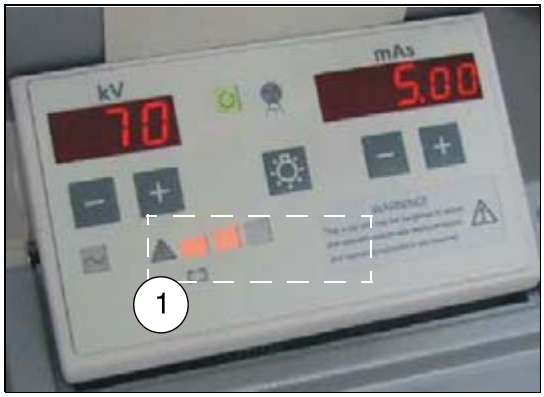

Fig. 15: Control and display

- Select all values using the "± kV/ ± mAs" keys.

See technical data in operator's manual; note line voltage.

Multileaf collimator function

- Completely open the collimator.
- Check the function of light keys on the collimator.
- Check the manual collimations with the light on.
- The light switches off after approx. 20 secs.
- Test the collimator light key on the control panel (Fig. 15 / p. 31).

Exposure release with high voltage

NOTE

If the “DAP" and/or "remote control“ options are installed, they can be tested for proper function during the following tests involving release of the X-ray radiation.

- Close the collimator and set the display on the control panel to 60 kV/10 mAs.
- The control display for "exposure circuit ready" must light up green (control panel, (Fig. 15 / p. 31)).
- Set the exposure switch (S27) to preparation and check the “exposure ready" acoustic signal (after approx. 2 seconds).
- Stop 'preparation' and check the cutoff time of approx. 15 seconds. ERR 25 appears on the display (preparation time without exposure).
- Acknowledge the error with the “collimator light" key on the control panel.
- Release an exposure.

  The radiation indicator (Fig. 15 / p. 31) lights up during the exposure; at the same time an acoustic signal sounds and the "exposure circuit ready" light goes out.
- “Exposure circuit ready" lights up again within 15 sec. max.

Manual termination of exposure

The user must be able to cancel an exposure at any time.

- Set a midrange kV value (e.g., 70 kV) and the highest possible mAs value.
- Release an exposure and interrupt it immediately. The display then reads "ERR 39" and 10 short acoustic signals sound (exposure aborted). Acknowledge the error message with the “collimator light" key on the control panel.

Light field/radiation field

- Prepare a 35x35 cm cassette with film.
- Place the cassette on a suitable support.
- Set SID to 100 cm (use the collimator's tape measure).
- Align the light localizer to the cassette and collimate to approx. 25x25cm.
- Mark the four sides and one of the corners (e.g. with coins / (Fig. 16 / p. 34)).
- Set the control panel to 55 kV/ 2.5 mAs and release an exposure.
- Develop the film.
- Measure the deviation between the light field and the radiation field ((Fig. 17 / p. 34)).

The permissible deviation is ± 1.7% of the SID ((Fig. 17 / p. 34)).

If the deviation is > 1.7%, the collimator must be adjusted (see “Replacement of parts").

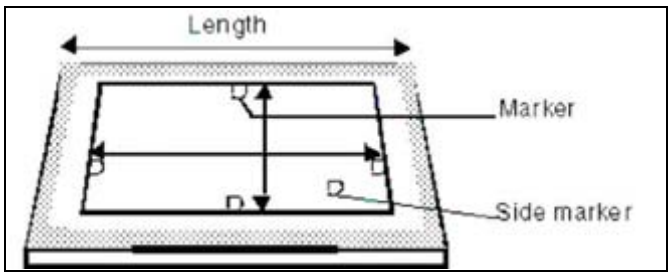

Fig. 16: Light field/radiation field, cassette

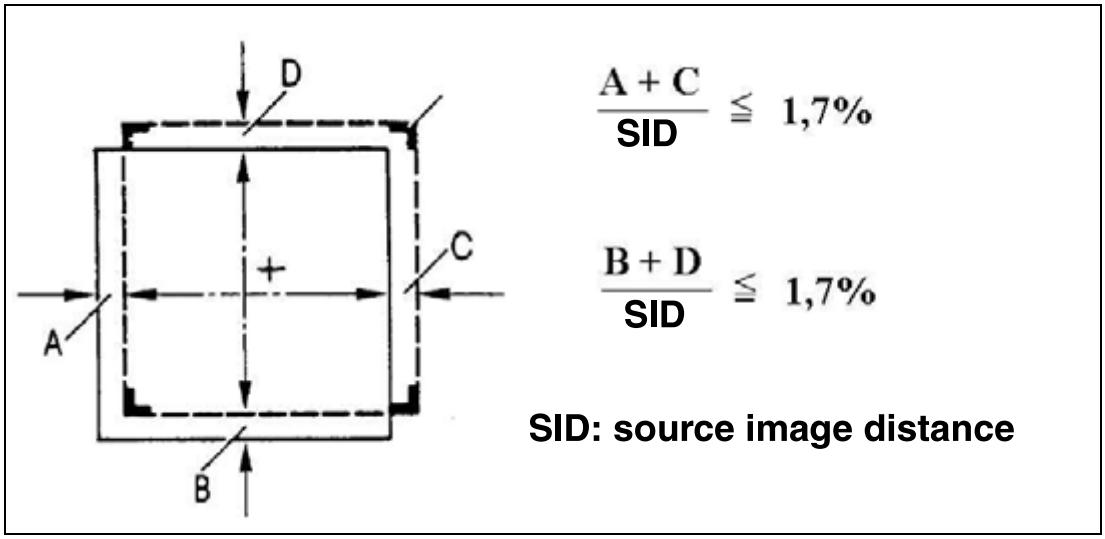

Fig. 17: Light field/radiation film

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Programmable device parameters

Various parameters can be changed at the customer's request. The procedure is described here. For detailed information, refer to the troubleshooting instructions (SPR8-230.840.01..).

kV/mAs

- Presetting after switch-on - default 70 kV/5.0 mAs.

  Service program Pr. 5 can be used to modify the preferred values or alternatively to activate the "last value function".

- Maximum kV/mAs values - default set to "Max."

  Display readings and selection options depend on the line voltage (see “Technical data" in the operator's manual).

  Change with service program Pr.6.

- Exposure points - standard 49 steps (47 steps for Eco).

  Change with service program Pr. 11 (decrease to 25 or to 24 steps for Eco).

"AUTO_Off" (Hybrid only)

The Auto_Off function is activated on delivery (the unit automatically switches off if not run in battery mode for 15 minutes).

Deactivate the function with service program Pr. 10.

Sound level of the keyboard (“beep”)

Predefined setting ’bep1’ = quiet; confirmation tone upon pressing the "kV," "mAs," or "collimator lamp" keys is OFF.

Change with service program Pr. 13.

Activating service programs

- Switch the unit off.
- Remove the upper cover.
- Set service switch SW2B to "Service Position 2" (PCB D916 / (Fig. 18 / p. 36)).
- Switch the unit on.

  ➪ "Pr. 1" is shown on the user display.
- Select the required service program with the "mAs+ / mAs-" keys.
- Activate the service program with the collimator lamp key.
- Change values with the "± kV" and/or "± mAs" keys.
- Enter the required value and quit the program with the collimator lamp key.

- Set service switch SW2B to "User position 1" and press reset button SW3 (PC board D916).
- Check the new values in the user function.
- Switch the unit off and reattach the upper cover.

Fig. 18: Top view D916 CPU

Options

DAP

Measuring device for dose area product (**D**ose **A**rea **P**roduct).

The DAP measuring device is used to measure the kerma area product (kerma = kinetic energy released in matter) during an X-ray examination. It is primarily used to record the radiation dose a patient has been exposed to.

The DAP is calibrated at the factory.

- Press the Test button on the DAP display.

  The displayed value must be in the range of 80-120 μGym^2 (DAP resolution 0.1 μGym^2) or in the range of 8-12 μGym^2 (if using a high resolution measurement chamber, i.e. DAP resolution 0.01 μGym^2).

  Otherwise, the DAP measuring system has to be calibrated according to the “Replacement of Parts” instructions.

- Verify the function of the DAP measuring system by releasing an exposure.

  The display has to show a measurement value.

Remote control

- Adhere the remote control holder to the front right or left side.
- Switch the MOBILETT on.
- Test the “collimator light" and “exposure release" functions.

NOTE

The following start-up steps vary according to the type of unit.

MOBILETT XP:

Continue with “Final activities".

MOBILETT XP Hybrid:

Continue with “Hybrid battery mode" and proceed to “Final activities".

Hybrid battery mode

First check the battery status (1/Fig. 15 / p. 31). To do this, turn off the unit (1/Fig. 19 / p. 39), disconnect the main power cord from the power supply and switch the selector (2/Fig. 19 / p. 39) to battery mode. Switch the unit on and check the battery status on the control panel.

NOTE

At least one of the display LEDs must light up for the tests in the battery mode (1/Fig. 15 / p. 31)

Otherwise, charge the batteries until this operating state is reached (min. charging time: 2 hrs.).

The batteries will charge only if the unit is connected to line voltage and switched off. The selector switch (2/Fig. 19 / p. 39)should be set to “0" for charging.

Tests in battery mode

- Disconnect the main power cord from the power supply and wind it completely around the cable spool.
- Using the selector switch, first switch the unit to battery mode. Then switch it ON.
- Check the battery status.
- Check the following functions according to the operator's manual:
  - Test of operating elements and displays

- Radiation release
- Collimator light
- Motor drive
- DAP display (optional)
- Remote control (optional)

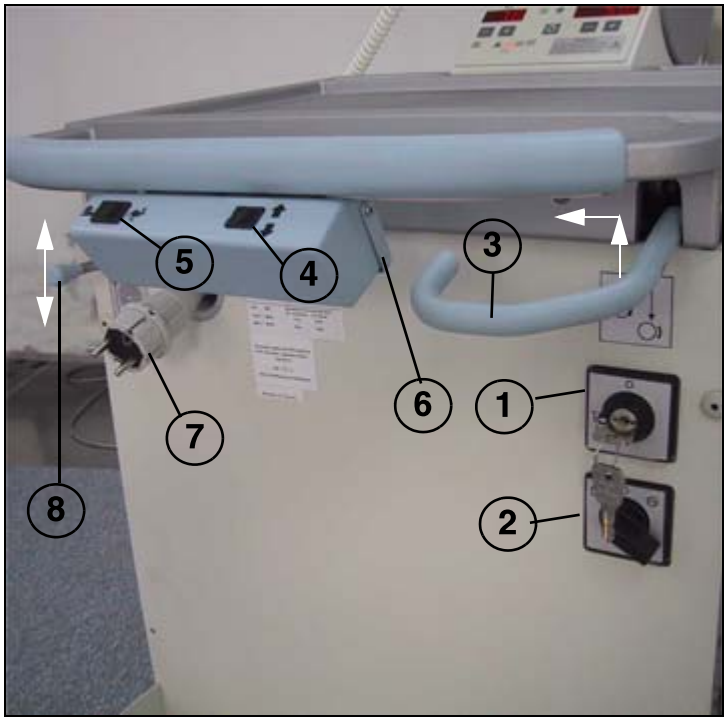

Fig. 19: User control, battery mode

(1) Power ON/OFF key switch

(2) Selector switch (battery/off/line)

(3) Hand brake

(4) Motor drive - forward / reverse

(5) Switch for low and high speed

(6) Automatic alert switch

(7) Main power cord

(8) Brake/release for cable winch

Final activities

NOTE

Within the purview of the USA, perform the DHHS checks ("DHHS" chapter) at this point.

- Turn off the unit and attach all cover parts.

Protective conductor test

Observe the protective conductor resistance test information in these instructions.

- Perform the protective conductor test with all covers closed, in accordance with ARTD-002.731.17... The protective conductor resistance must not exceed 0.2 Ohms.

✍ • Record the determined values as the first measured values in the protective conductor resistance report (chapter 8 of these instructions), and indicate the measuring points.

✍ • The measuring procedure and the measuring device used (designation and serial number) must also be documented.

Leakage current measurement

Observe the leakage current measurement information in these instructions.

- Measure the leakage current with all covers closed, in accordance with ARTD-002.731.17... The limit value of 2.5 mA must not be exceeded.

⚠WARNING

Electrical voltage!

Non-compliance can lead to severe injury and even death.

- ➪ **No housing parts of the system may be touched during direct measurement of the leakage current .**
- ➪ **Third-person access to the system must be prevented.**

- The system must be switched on during measurement. Measuring devices with automated measuring sequences must therefore be set to manual measurement.

✍ • Enter the highest value as the first measured value in the leakage current report (chapter 8 of these instructions).

- This value must not exceed the permissible leakage current values according to DIN VDE 0751-1/2001-10, Table F.1, line "leakage current for devices according to remarks 1 and 3", of 2.5 mA.

✍ • Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. This must also be documented.

✍ • Document the measuring procedure (differential measurement or direct measurement) and the measuring instrument used (designation and serial number).

Reports

- Separate the completed 'Start-up report' (chapter 6 of these instructions) from these instructions and file it in the system binder, Register 9, "Certificates."

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- Separate the completed DHHS report (chapter 7 of these instructions) from these instructions and file it in the system binder, Register 9, "Certificates."

- Separate the completed protective conductor resistance report and leakage current report (chapter 8 of these instructions) from these instructions and file them in the system folder, Register 9, "Certificates."
- Complete the installation protocol included with the unit and send it (by fax) to the address given in the protocol.

DHHS tests (scope of validity: USA only)

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The following tests must be performed and recorded to satisfy the DHHS requirements:

- kV accuracy
- mAs accuracy
- Reproducibility

Test of kV accuracy

Requirement:

The measured kV values must comply with the limit values specified in the tables. One of two measuring methods can be used:

1. kV meter method:
   - kV meter based on the filter comparison technique (e.g. PTW-Nomex) Use the correction factor given in the kV meter operator's manual for non-invasive kV measurements.
2. Oscilloscope method:
   - Storage oscilloscope with a measuring accuracy of ± 2.5%

Technique with the kV meter:

NOTE

The inherent filtration (AL equivalent) of MOBILETT XP and Hybrid is 3.1mm Al (single tank plus collimator).

An installed DAP measurement chamber increases the inherent filtration by 0.4 mm AL.

- Prepare the kV meter for the measurement according to the operator's manual.
- Place the measuring detector on a suitable surface and adjust the single tank to the detector with the light localizer (Fig. 20 / p. 43).
- Set the source-image distance to the value specified in the kV meter operator's manual.

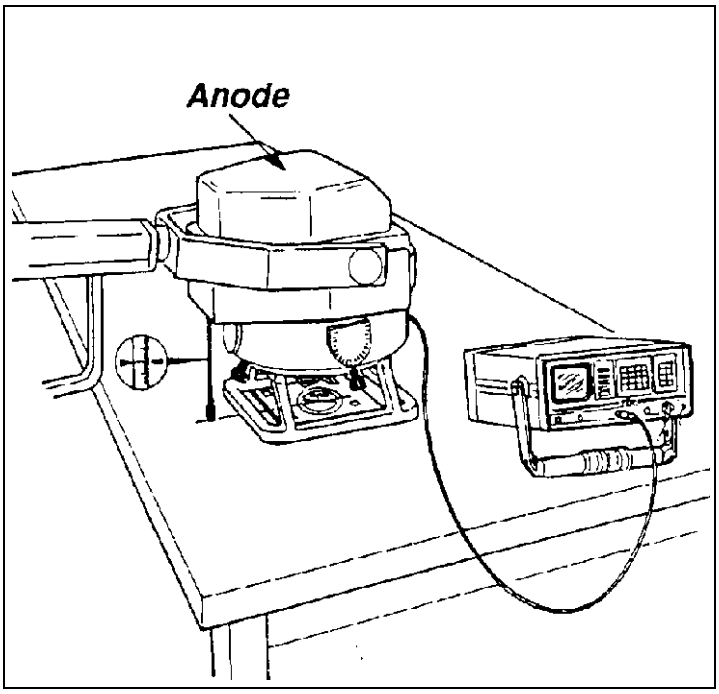

Fig. 20: kV measurement

For MOBILETT XP:

- Connect the power plug and turn the unit power switch "ON".

For MOBILETT XP Hybrid:

- Disconnect the power plug; first switch the unit to the battery mode and then "ON".
- Set the following exposure parameters and release an exposure after each setting:

kV meter Selection	Exposure parameters		Limit values*
DC voltage	52 kV	50 mAs	49.0 - 55.0 kV
	81 kV	20 mAs	77.0 - 85.0 kV
	133 kV	12.5 mAs	126.4 - 139.6 kV

***** The measuring inaccuracy of the measuring instrument used must be deducted from the specified limit values.

✍ Record the measured values.

Additional test for the MOBILETT XP Hybrid

- Connect the power plug and switch the unit “ON" in the “line-powered" mode.
- Set the following parameters and release an exposure:

kV meter Selection	Exposure parameters		Limit values*
DC voltage	81 kV	20 mAs	77.0 - 85.0 kV

✍ Record the measured value.

Oscilloscope method:

"KVS" measuring point for the nominal value and “KV" measuring point for the actual value. The measuring ratio is 30 kV/V.

- Open upper unit cover; measuring points on CPU D916 (see troubleshooting instructions).
- Follow the same procedure as described in “kV meter method".

Test of mAs accuracy

Requirement:

The measured mAs values must comply with the limit values specified in the tables. One of two measuring methods can be used:

1. mAs meter method:
   - mAs meter (e.g. MAS meter 8160400 with a measuring accuracy of 1% ± 1 digit)
2. Oscilloscope method:
   - Storage oscilloscope with a measuring accuracy of ± 2.5%

Oscilloscope method:

- Close the multileaf collimator and open the upper unit cover.
- Clamp the oscilloscope to the “JR" and “GND" measuring points on CPU D916.

For MOBILETT XP:

- Connect the power plug and switch the unit to the battery mode first and then to "ON".

For MOBILETT XP Hybrid:

- Disconnect the power plug; first switch the unit to the battery mode and then “ON".
- After switching the unit on (switch setting: “ON"), wait for approx. 5 minutes to let it stabilize.

Example: Calculation of the mAs value

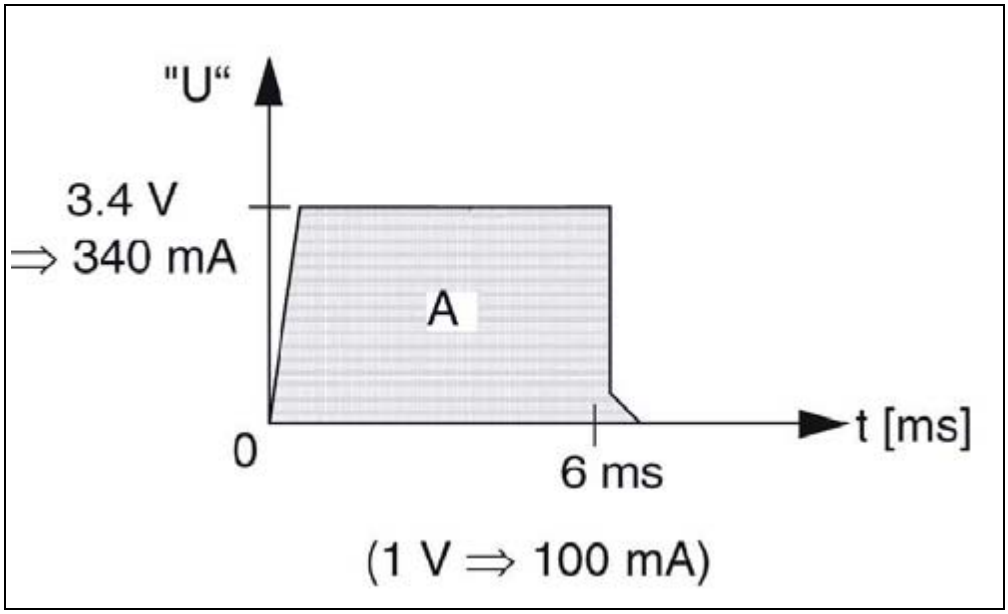

Fig. 21: mAs calculation

The mAs value can be calculated with the help of the oscilloscope display.

Surface “A" corresponds to the mAs value.

mAs = tube current X exposure time

mAs = 340 mA x 0.006 s = 2.0 mAs

- Determination for the following exposure parameters (product of tube current x exposure time):

Control unit setting		Permissible mAs value*
kV	mAs	
40	5	4,7 - 5,3
81	2	1,9 - 2,1
133	10	9,5 - 10,5

* The measuring inaccuracy of the measuring instrument must be deducted from the specified limit values.

✍ Calculate and record the mAs values.

Additional test for the MOBILETT XP Hybrid

- Connect the power plug and switch the unit “ON" in the “line-powered" mode.
- Set the following parameters and release an exposure:

Set the control unit to:		Permissible mAs value*
kV	mAs	
81	2	1,9 - 2,1

✍ Calculate and record the mAs value.

mAs meter method:

Use of the mAs jumper on PCB D907 directly on the single tank.

- Remove cover from single tank and connect mAs meter to D907 (1/Fig. 22 / p. 47).
- Follow the same procedure as described in “Oscilloscope method".

  For more information on the measuring technique, refer to the user's manual for the mAs meter.

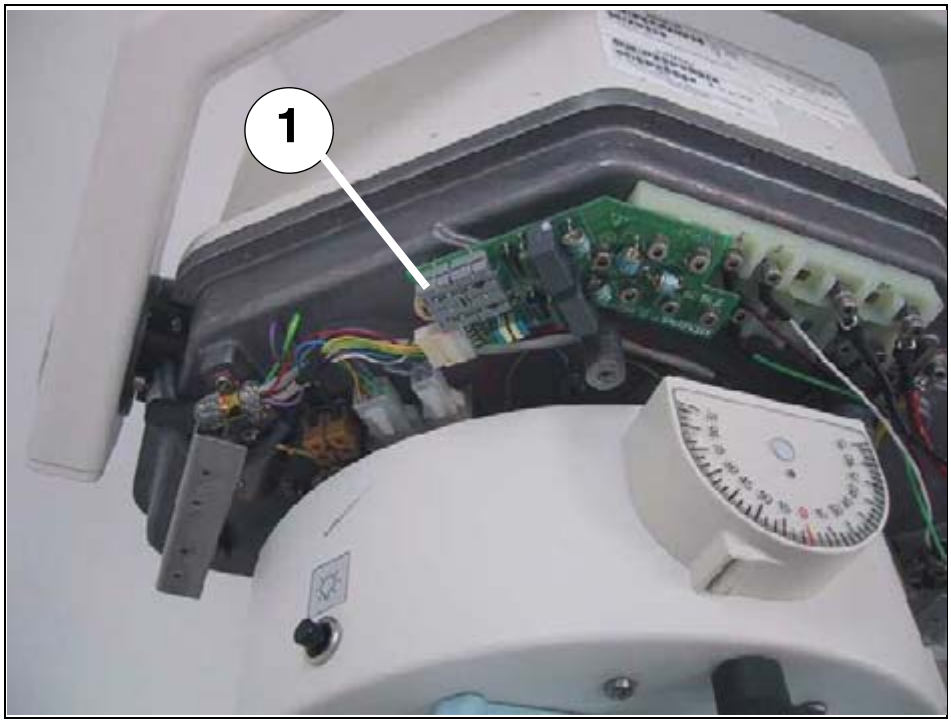

Fig. 22: mAs jumper D907

Reproducibility test

Requirement:

- The coefficient of variation for the radiation dose for any combination of exposure parameters does not exceed 0.045. This requires operation at the line voltage compliant with Siemens specifications.

NOTE

In the following test, 10 sequential exposures are taken within one hour.

The exposure parameters should be briefly set to different values following each measurement.

Required measuring instrument:

- Dosimeter

Procedure:

- After switching the system on, wait until its temperature has stabilized. The unit is ready for these measurements after 15 minutes.

- Release the number of exposures with the specified exposure data:
  - 85 kV, 1.0 mAs, 10 exposures.
- Measure the dose for each exposure.
- Reset the display prior to each new measurement.

  Calculations: Coefficient of variation C
- Coefficient of variation C is determined for a series of 10 dose measurements with the following formula:

$$c = \frac{s}{\bar{x}} = \frac{1}{\bar{x}} \left[\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n - 1} \right]^{1/2}$$

Fig. 23:

s = Standard deviation resulting from the measurements

$\bar{x}$ = Average measurement of series

x_i = i. measurement of series

n = Number of individual measurements in series

Coefficient of variation C must be $\leq$ 0.045.

Example for determining coefficient of variation C:

Step 1)

- 10 exposures with recorded measurements (fictitious measured values).

Exposure (n=10)	Measured values (xi)
1	1,01
2	1,02
3	1,03
4	1,04
5	1,03
6	1,02
7	1,02
8	1,01
9	1,03
10	1,04

Step 2)

- Addition of measured values:

  $\sum = 1{,}01 + 1{,}02 + 1{,}03 + 1{,}04 + 1{,}03 + 1{,}02 + 1{,}02 + 1{,}01 + 1{,}03 + 1{,}04 =$ **10,25**

Calculation of mean value:

$$\bar{x} = \frac{\Sigma}{n} = \frac{10.25}{10} \Rightarrow \bar{x} = 1.025$$

Fig. 24:

Step 3)

Calculation of standard deviation:

$$s = \sqrt{\frac{(x_i - \bar{x})^2}{n - 1} + \ldots} =$$

Fig. 25:

$$\sqrt{\frac{(1.01-1.025)^2}{9}+\frac{(1.02-1.025)^2}{9}+\frac{(1.03-1.025)^2}{9}+\frac{(1.04-1.025)^2}{9}+\frac{(1.03-1.025)^2}{9}+\frac{(1.02-1.025)^2}{9}+\frac{(1.02-1.025)^2}{9}+\frac{(1.01-1.025)^2}{9}+\frac{(1.03-1.025)^2}{9}+\frac{(1.04-1.025)^2}{9}}=S$$

Fig. 26:

$$\sqrt{2.5\times10^{-5}+2.8\times10^{-6}+2.8\times10^{-6}+2.5\times10^{-5}+2.8\times10^{-6}+2.8\times10^{-6}+2.8\times10^{-6}+2.5\times10^{-5}+2.8\times10^{-6}+2.5\times10^{-5}} \Rightarrow s=0.0108$$

Fig. 27:

Step 4)

- Calculation of coefficient:

$$C=\frac{s}{x}=\frac{0.0108}{1.025}=0.0105$$

Fig. 28:

In this example, the generator complies with the specification:

C = 0.0105, hence it is ≤ 0.0450.

- Perform the described procedure and note the results in the DHHS report.
- Complete the DHHS report.

MOBILETT XP (Hybrid)

This protocol confirms operability according to the datasheet. The original document remains with the unit, and a copy is filed at the local branch office.

Type / Material No. / Serial No.: .....

Customer: ..... **Customer No.:**
.....

Check	Control point	Additional information
❒	Required documents complete	
❒	Visual inspection	
❒	Cable winch	
❒	Support arm movements	
❒	Single tank and collimator movements	
❒	Identification	
❒	Line voltage	_____V
❒	Operating Elements and Displays	
❒	Multileaf collimator function	
❒	Exposure release with high voltage	
❒	Light field/radiation field	Deviation ≤ ± 1.7 %
Programming service programs		
❒	kV/mAs display with unit "ON" (Pr.5)	_____kV_____mAs or “Last value - function” ❒
❒	kV/mAs maximum values (Pr.6)	_____kV_____mAs (Mains operation) _____kV_____mAs (Battery mode - Hybrid only)
❒	Exposure points (Pr.11)	25 (24)____/_____49 (47)
❒	AUTO OFF (Pr.10 **Hybrid only**)	active/inactive
❒	Sound level of the keyboard (Pr. 13)	bep_____
Options		

❒	DAP	Display _____ µGym^2
❒	Remote control	
Hybrid battery mode		
Check	**Control point**	**Additional information**
❒	Loading battery	
❒	Controls and displays	
❒	Radiation release	
❒	Collimator light	
❒	Motor drive	
❒	DAP option	
❒	Remote control option	
Final activities		
❒	Protective conductor test (Measurement values in separate protective conductor resistance report)	
❒	Leakage current measurement (Measurement values in separate leakage current report)	
Name: _____ Date:_____ Signature:_____		

MOBILETT XP (Hybrid)

The original document remains with the unit, and a copy is filed at the local branch office.

Type / Material No. / Serial No.: .....

Customer: ..... **Customer No.:**
.....

kV accuracy (XP line mode / Hybrid battery mode)			
Check	**Control point**	**Check value**	**Additional information**
❒	52 kV / 50 mAs	_____ kV	Measuring instrument: _____
❒	81 kV / 20 mAs	_____ kV	Serial no.: _____
❒	133 kV/12.5 mAs	_____ kV	Date of calibration: _____
kV accuracy (Hybrid line mode)			
❒	81 kV / 20 mAs	_____ kV	
mAs accuracy (XP line mode / Hybrid battery mode)			
❒	40 kV / 5 mAs	_____ mAs	Measuring instrument: _____
❒	81 kV / 2 mAs	_____ mAs	Serial no.: _____
❒	133 kV/10 mAs	_____ mAs	Date of calibration: _____
mAs accuracy (Hybrid line mode)			
❒	81 kV / 2 mAs	_____ mAs	

Reproducibility

❒	Dose measure-ment	Coefficient of variation C:	Measuring instrument: _____
		_____	Serial no.: _____
			Date of calibration: _____

Name: _____ Date:_____ Signature:_____

Protective conductor resistance/report

System: .....

Material number: .....

Serial number: .....

Customer-spec. ID number: .....

Tab. 1

	Protective conductor resistance					
	First measured value	Repeat measurement values				
Meas. point 1:						
Meas. point 2:						
Meas. point 3:						
Meas. point 4:						
Meas. point 5:						
Meas. point 6:						
Meas. point 7:						
Meas. point 8:						
(*1) Meas. circuit:						
Measuring device type:						
Meas. inst. ser. no.:						
Meas. inst. calibrated up to:						
Evaluation:	n.a.					
Date:						
Name:						
Signature						

(*1) Meas. circuit: See (Fig. 29 / p. 56)

Measuring circuit

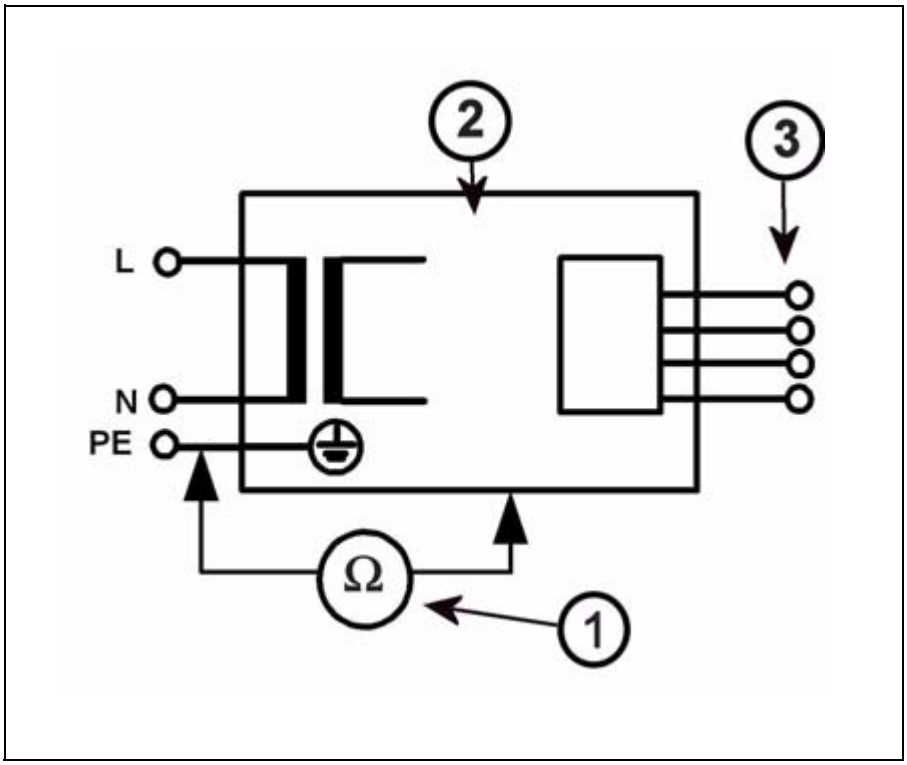

Fig. 29: Measuring circuit for measuring the protective conductor resistance for units that are disconnected from power, in compliance with DIN VDE 0751-1/2001-10, Fig. C2.

Pos. 1 Measurement setup (measuring device)

Pos. 2 System

Pos. 3 Application part (if applicable)

Remarks:

Tab. 2

Date	Comments	Name	Signature

Leakage current/report

System: .....

Material number: .....

Serial number: .....

Customer-spec. ID number: .....

Tab. 3

Leakage current						
	First measured value	**Repeat measurement values**				
Leakage current (Highest measured value) [mA]						
Line voltage during the measure-ment [V~]						
Leakage current, corrected value [mA]						
(*1) Meas. circuit:						
Measuring device type:						
Meas. device ser. no.:						
Measuring device, calibrated to:						
Evaluation:						
Date:						
Name:						
Signature:						

(*1) Meas. circuit: See (Fig. 30 / p. 58) through (Fig. 31 / p. 58)

Measuring circuit

Direct measurement

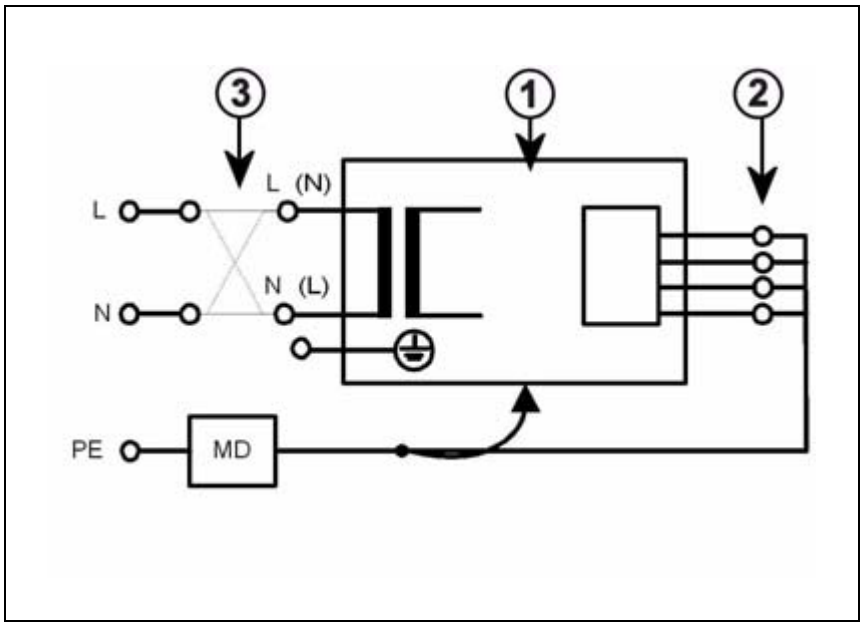

Fig. 30: Measuring circuit for direct measurement of the system leakage current in compliance with DIN VDE 0751-1/2001-10, Fig. C5 for protection class I.

Pos. 1 = System

Pos. 2 = Application part type B (if available)

Pos. 3 = Measurement setup (integrated into measuring device)

Differential measurement

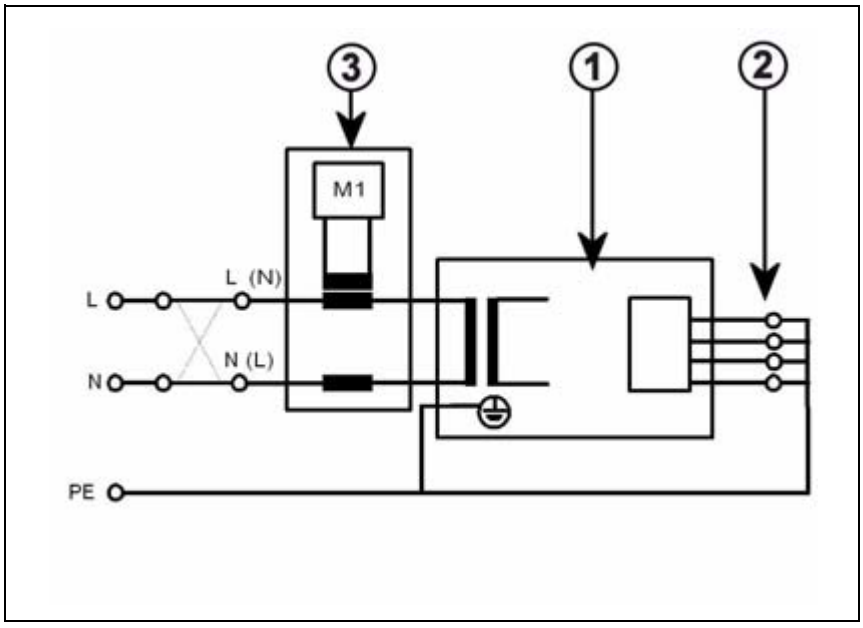

Fig. 31: Measuring circuit for measuring the system leakage current according to the differential current method in compliance with DIN VDE 0751-1/2001-10, Fig. C6 for protection class I.

Pos. 1 = System

Pos. 2 = Application part type B (if available)

Pos. 3 = Measurement setup (integrated into measuring device)

Remarks:

Tab. 4

Date	Comments	Name	Signature

Date	Comments	Name	Signature

Chapter	Section	Revision
General start-up information	Information on the protective conductor resistance test	New section added
General start-up information	Information on measuring the leakage current	New section added
Unpacking and visual inspection	Unpacking	New illustration added.
Functional check Programmable device parameters	Keyboard sound level	Adapted to new FW
Functional check Final activities	Protective conductor test	Completely rewritten
Functional check Final activities	Leakage current measurement	Completely rewritten
Functional check Final activities	Reports	Adapted in accordance with changes
Start-up Certificate	n.a.	Adapted in accordance with changes
Electrical safety Reports	n.a.	New chapter added.